

observatory note-books for drawings of *Jupiter* from 1863 to 1867. He only finds two drawings during this period with anything like white egg markings; the first on June 23, 1863, and the second in August 1866, with two white spots; one in a southern, the other in a northern belt; but he thinks that they have evidently nothing to do with the egg markings of 1860–1870.

It is unnecessary here to give any account of the reappearance of the same phenomena during the recent Sun-spot maximum. I append a Sun-spot curve for the period 1834–1870.

On account of the interest attached to the question of the variability of the Nebula of  $\eta$  Argús, the Council have determined to print as well Mr. Abbott's communications as the remarks upon them by the late Sir J. F. W. Herschel, and the Astronomer Royal. For convenience of reference it may be mentioned that Mr. Abbott's former papers are printed in the *Monthly Notices*, vol. xxi. p. 230 (June 1861); vol. xxiv. p. 2 (November 1863), with plate; vol. xxv. p. 192 (April 1865, paper dated 18th February); and vol. xxviii. p. 200 (May 1868, paper dated 29th February), with a plate; and that there is a paper by Sir J. F. W. Herschel, vol. xxviii. p. 225 (June 1868); and one by him and Lieut. Herschel, vol. xxix. p. 82 (January 1869), with five plates.—ED.

*Some further Observations on the Variable Star  $\eta$  Argús, and its Surrounding Nebula.* By F. Abbott, Esq.

I now forward to the Society, after a period of two years, a third drawing,\* with some remarks in reference to more recent observations on the inequality of motion, and variation in aspect of  $\eta$  Argús, and the surrounding Nebula.

On my last communication some critical remarks were made, with a view of disproving that which I never intended to prove. This, in all probability, arose from my not having expressed myself with sufficient clearness in my remarks on the drawing which accompanied the observations. In this way the road to truth often runs through the midst of error, but that does not in any way alter the fact that great changes have been, and still are, taking place in the object under consideration.

Perhaps the field given in the drawing of 1868 may be somewhat too large, as it was my first intention to have made it larger; but, finding that the changes were principally confined to  $\eta$  and the so-called Lemniscate,† I confined the drawing to the size of the field given with the eye-piece.

\* See plate of  $\eta$  Argús as taken Jan. 28, 1870.—Ed.

† I scarcely think this term a good one :—Lemniscate, or Lemniscus; a curve formed as the figure 8, or a bow tied of a riband—Barlow and B. H. Smart. Such a curve is closed in the centre, which is not the case in the Cape drawing, it being there shown as a long enclosure slightly compressed in the centre. It was in this compressed part that the star  $\eta$  appeared when out of the dense Nebula.

As some objections have been raised on the ground that larger optical means than those employed by me were required for recording truthfully the changes which take place in this object, it may be well, perhaps, to state that the 5-foot Equatoreal previously mentioned is not the only instrument employed. Other telescopes have been used in the open air, from a  $3\frac{1}{2}$ -foot Cook and Sons, to a 7-foot Dollond, with, for the whole, a complete battery of micrometers and eye-pieces, giving magnifying powers of from 25 to 450. This statement may go towards proving that observations can be correctly made without very large instruments.

In Mr. Proctor's article on the Nebula in *Argo* (*Fraser's Magazine* for December 1868) it is stated not to be quite clear that the stars which appear in my drawing of 1868 have been really copied from the view given by the telescope, &c. In reply to this, I beg to remark that all the drawings, the present as well as the former ones, were carefully copied from the object, as described in the *Astronomical Register* for January 1869. There is little doubt but that Mr. Proctor's views on this subject would be much enlarged if he had the opportunity of seeing the star and Nebula as they appear in the telescope, when above the Pole, at Hobart Town.

By these means, and having seen the object in the Melbourne reflector, I feel armed with sufficient courage to communicate what I have observed regarding the changes which have taken place in this object during the last two years.

In comparing the present drawing with that of 1868, it will appear clear that alterations have taken place, both in the magnitude of the star  $\eta$  and in the dispersion of the Nebula; and from what follows it will be seen that the remarks made by Professor Loomis and others on the period of this star are premature. When in Melbourne in June last, and while observing the object, Mr. Ellery considered the star  $\eta$  to be of the seventh magnitude, and Mr. Le Sueur thought it  $6\frac{1}{2}$ . On my return to Hobart Town, I continued to observe it, and from careful comparisons made with the stars given in the drawing, and recorded in the Cape Catalogue, it cannot be of more than the seventh magnitude. In the Cape Catalogue there are two stars of the sixth, and nine of the seventh magnitude; the remainder are all low magnitude stars. The two sixth magnitude stars are out of the field. With the nine seventh magnitude stars in the field, they are by careful comparison exactly the magnitude of  $\eta$ , which is left amongst them not marked.

The magnitudes of these stars are those given by Sir J. Herschel, and may be considered correct.

Measures are recorded to have been made of these stars by small transit means; but, from my own experience in transit observations, I believe it to be all but impossible to measure correctly such a cluster of small zenith stars by such means. Two years ago I dismounted a 24-inches transit by Varlëy, in order to replace it with a 30-inches by Dallmeyer, made with a deep dia-

gonal eye-piece, for the purpose of reaching small zenith stars up to the seventh magnitude, as agreed upon for correcting any error in longitude between Hobart Town and Melbourne. Mr. Ellery selected forty-nine such stars, which were to be used at both places, reversing the instruments at each observation so as to eliminate any errors. With these means, and for this purpose, I find it difficult, and only under very favourable circumstances possible, to reach stars of the seventh magnitude.

My reason for not attempting measures with the Equatoreal is, in consequence of a long-experienced difficulty arising from the want of clock movement, which I consider indispensable for the accurate measurement of distances. I preferred, therefore, an eye-and-hand drawing, when the object has been in a convenient position, approximately  $75^\circ$  from the meridian towards the east, and  $35^\circ$  from the zenith.

The alterations which have taken place in the Nebula since 1868 will at once be seen on an inspection of the drawings, and by comparing them with each other. In the Cape Monograph, the dark space is an inclosure. In 1863 it had two openings, one at each end. In 1868 there were four openings; and now, in 1870, there are five which expose a number of isolated and distinct stars, rendering it difficult, but from position, to know which is the star  $\eta$  Argûs. There is attendant on these changes an increase of light which is notable up to the present time. During the last three full Moons (December, January, and February), when both the object and the Moon are approaching the meridian, the light around  $\eta$  Argûs is distinctly seen when all other Nebulæ are shut out. This increase of light may arise from one of two causes; either the Nebula has become concreted into isolated stars, or in its dispersion it has laid bare distinct stars which give out more light. The same physical forces that have worked out our own solar system are still at work in the stellar universe. Creation is still going on, and why not?

*Private Observatory, Hobart Town,  
Tasmania, Feb. 15th, 1870.*

P.S.—I may mention, in conclusion, that I have on several fine nights tried one of Mr. Huggins' hand spectrum telescopes, as described in the *Proceedings of the Royal Society*, vol. xvi. No. 98, without being able to detect any appearance of bright lines in the Nebula of  $\eta$  Argûs, such as those seen in that of *Orion*.

#### *Remarks on Mr. Abbott's foregoing Paper on $\eta$ Argûs.*

By Sir J. F. W. Herschel, Bart.

Pursuant to the request of the Council of the Royal Astronomical Society, I have carefully perused Mr. Abbott's communication on  $\eta$  Argûs, dated Feb. 15, 1870, and examined the dia-